

# Communication and Ranging Subsystem for a Distributed Spacecraft Configuration, Phase I

Completed Technology Project (2018 - 2019)



## Project Introduction

For NASA's exploration beyond Low Earth Orbit (LEO), a Distributed Spacecraft Mission (DSM) model would distribute sensors, on board processing, mass storage and downlink communications to different smaller physical satellites. Within this DSM format the wired bus must be replaced by a wireless 'cross-link' communication system that provides seamless connectivity between the individual modules at data rates similar to those available on the networks within a single satellite system.

Aeronix proposes an innovative, value centric contribution to develop a cross-link communication subsystem with two-way ranging built in to the physical layer by leveraging existing Aeronix Nano COTS Software Defined Radio (SDR) and open-source technologies, along with previous work on distributed satellite communication from the DARPA F6 distributed satellite program.

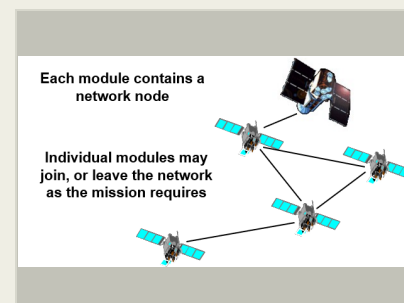
The communication and ranging subsystem will provide connectivity across modules using existing open source network software and COTS hardware, incorporating NASA's delay/disruption tolerant networking (DTN) standards, as well as providing automatically updated ranging data between mesh nodes. Externally the radio will appear as a managed switch to the module applications.

The results of the Phase I effort are expected to be a conceptual design of the communication and ranging subsystem, with expected link and ranging performance characteristics, and realistic mass, size, weight and power estimates.

## Anticipated Benefits

The communication with built-in ranging technologies could be used by NASA for other applications where communication between multiple independent vehicles is needed, especially in harsh environments. An example would be in communications between multiple independent rovers on the Moon or Mars.

Applications for robust miniature communication systems exist within NASA, the DoD and the commercial markets. The target of this research is for small satellite use, however, the ability to provide this capability in a very low size, weight and power form factor is also applicable to multiple UAV based applications. The distributed node communication and ranging mesh concept also has application for use in location determination between vehicles in GPS denied areas.



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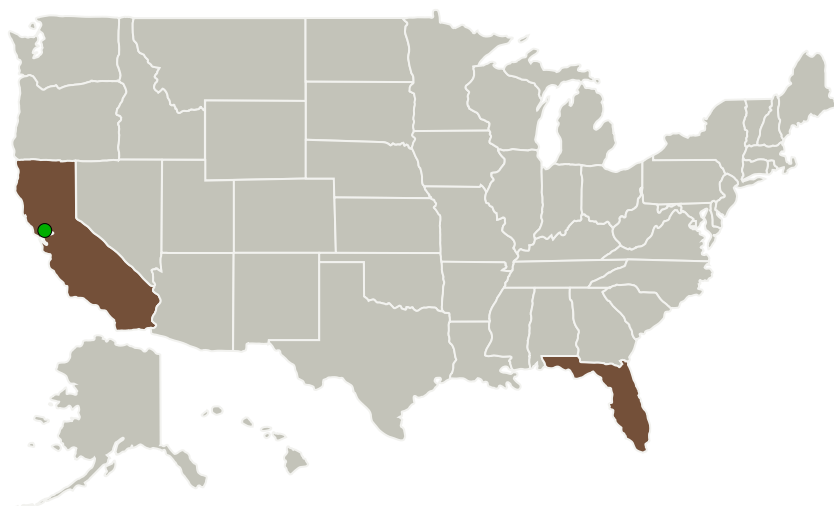
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## Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Aeronix, Inc.	Lead Organization	Industry	Melbourne, Florida
● Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California

Primary U.S. Work Locations	
California	Florida

## Project Transitions

**July 2018:** Project Start

**February 2019:** Closed out

### Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/141309>)

## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Lead Organization:

Aeronix, Inc.

### Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

### Program Director:

Jason L Kessler

### Program Manager:

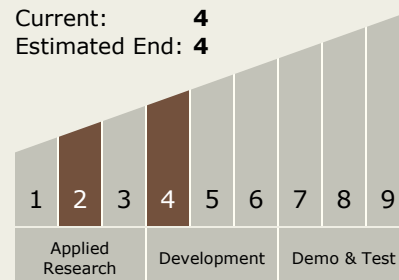
Carlos Torrez

### Principal Investigator:

Stephen Cremerius

## Technology Maturity (TRL)

Start: **2**  
Current: **4**  
Estimated End: **4**

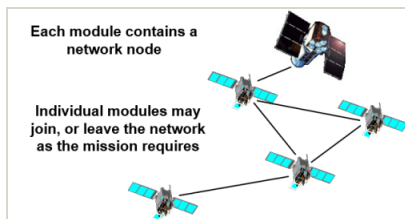


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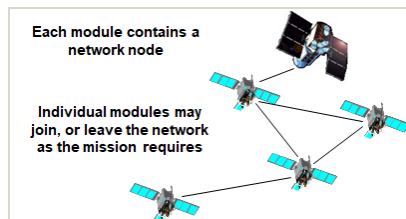


## Images



### Briefing Chart Image

Communication and Ranging Subsystem for a Distributed Spacecraft Configuration, Phase I (<https://techport.nasa.gov/image/134663>)



### Final Summary Chart Image

Communication and Ranging Subsystem for a Distributed Spacecraft Configuration, Phase I (<https://techport.nasa.gov/image/134879>)

## Technology Areas

### Primary:

- TX05 Communications, Navigation, and Orbital Debris Tracking and Characterization Systems
  - └ TX05.1 Optical Communications
  - └ TX05.1.6 Optometrics

## Target Destinations

Earth, The Moon, Mars